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VERBAL VERSUS GRAPHIC PRESENTATIONS OF LEARNING MATERIAL.

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THE PROBLEM WAS TO DETERMINE WHICH CONDINATIONS OF VERBAL AND GRAPHIC MATERIALS LEAD TO THE MOST EFFICIENT LEARNING. NINETY-ONE UNIVERSITY COLLEGE STUDENTS WERE DIVIDED INTO EIGHT GROUPS WHICH READ THE SAME INSTRUCTIONAL MATERIAL (ON ELECTRICAL CIRCUITRY) IN VERBAL, GRAPHIC, VERBAL-GRAPHIC, OR GRAPHIC-VERBAL FORM. HALF OF THE SUBJECTS WERE PRETESTED ON THE MATERIAL. A RECALL AND RECOGNITION POST-TEST (WITH BOTH VERBAL AND GRAPHIC ITEMS) WAS ADMINISTERED IMMEDIATELY AFTER READING. THE FINDING THAT THERE WERE NO RETENTION DIFFERENCES AMONG THE VARIOUS GROUPS CONFIRMS EARLIER RESEARCH. COLLEGE STUDENTS EVIDENTLY CAN PROFIT EQUALLY FROM THESE DIFFERENT TYPES OF PRESENTATIONS. TABLES AND REFERENCES ARE INCLUDED. THIS PAPER WAS PRESENTED AT THE AMERICAN EDUCATIONAL RESEARCH ASSOCIATION CONFERENCE (CHICAGO, FEBRUARY 6-10, 1968). (AUTHOR/BK)

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Verbal Versus Graphic Presentations of Learning Material

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Both verbal and graphic materials have long been used, but there is limited information on their relative merits as instructional aids. A series of studies (Vernon 1946; Vernon 1950; Vernon 1953) has indicated no advantage for either method, although two studies (Vernon, 1950; Culbertson and Powers, 1964) have shown significant relationships between memory, comprehension, and general intelligence.

A critical factor, as Goss (1966) points out, which is absent in the earlier research, is that there must be a 1:1 correspondence between the verbal and graphic presentations of the same content. This correspondence can be seen between the following sentence and figure. "In a simple[1] series circuit[2] the current travels a single path[3] from base[4] to plate,[5] passing through resistor(s) in that path."

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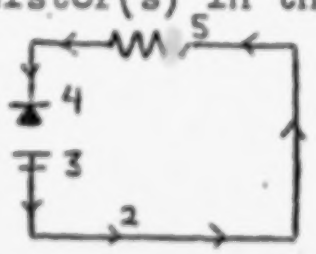

Simple Series[1]

Certain basic questions were postulated for this study. The primary problem was whether Ss learn better from verbal, graphic, verbal followed by graphic, or graphic followed by verbal presentations of information. Another question concerned the ability of Ss to solve factual or application problems, recognition, or recall-type questions as a function of these types of presentations. Finally, the relationship between Ss performance and various abilities was explored.

Method

Design A 2x4x2 analysis of variance was used. Factor one was pretest condition, factor two method presentation, and factor three type of test (recognition-recall). Another analysis was carried out using verbal and graphic subtests as the last factor.

Apparatus

Tests. Two paper and pencil tests, Test B and Test CF, were used to measure general intelligence. Test B consisted of 13 Questions taken from factor B (general intelligence) of the Sixteen Personality Factor Test. Test CF is the Culture-Fair Test which provides a single non-verbal measure of intelligence. In addition, College Entrance Examination Board Mathematics and Verbal SAT scores were available.

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The pretest of Ss knowledge included four subtests: Recognition (RO); Recall (RA); Verbal (V); and Graphic (G). The multiple-choice RO subtest included questions which corresponded to material in the reading. The RA subtest was covered to serve information except that no alternative responses were provided S. The V and G subtests were both recall questions, the two subtests having a perfect correspondence (as do the verbal and graphic readings). That is, the V and G subtests questions presented and required the same information. Tests RO and RA had 14 items each, while tests V and G had 10 items each. The V and G subtests are application items which require the application of formulas given in the reading.

The 48 item posttest was the same as the pretest.

Instructional materials in verbal (V), graphic (G), verbal-graphic (VG), and graphic-verbal (GV) forms were used. The verbal material was about 600 words and there were eight graphs. Both verbal and graphic selections provided detailed examples and formulas. The verbal-graphic material consisted of the text, then pages with graphic material, and the graphic-verbal was identical but the graph appeared before the text.

Procedure

Ninety-one University of Massachusetts undergraduate subjects were randomly assigned to seats in a large auditorium. Test B and Test CF were administered. Subjects were then told to study the circuitry symbols and the reading material in the order presented and that there would be a test on this material. An explanation of the circuitry symbols (included in the introductory materials) showed the symbols, their verbal identifications, and how to use them.

Half the Ss received the pretest test before the reading. The other Ss were given the self-paced reading selections (which had been arranged in random order) and which consisted of the circuitry symbols and explanations, written instructions, and one of four forms of reading, verbal, graphic, verbal-graphic, or graphic-verbal, and finally the posttest. The Ss who took the pretest received this reading selection after they had finished the pretest. Subjects were allowed to leave when they had completed the posttest. They were required to record the time they began and completed the reading materials.

Results

Table 1 (see tables at end) presents the means on all four subtests for the four methods of presentation.

Table 2 presents the significant correlations out of 28 possible variables. The significant correlations between subtests RO and RA, and for subtests V and G, confirm that the alternate combinations of two subtests covered the same material. The odd-even reliability coefficient for the posttest was .72 for 91 Ss.

The analyses of variance revealed that there was no significant difference in learning as measured by the final test scores among verbal, graphic, verbal-graphic, or graphic-verbal groups. Previous studies have shown a superiority of filmstrips only over films and instructors (Vernon, 1946), but no difference has been found in learning from pictorial charts, pictograms, or graphs (except among individuals), and no significant difference has been found in learning from text followed by charts, texts and charts simultaneously, and charts followed by text (Vernon, 1950). It appears, therefore, that this study and past research, although not proving the null-hypothesis, argues strongly for the conclusion that there is little difference between verbal and graphic methods of presentation. Text and graphic presentations then, are coordinated systems for communicating about the same topic. Obviously, from Table 1, the factual type information was better retained. As a general conclusion it can be said that Ss in this experiment learned the facts but did not learn to apply them. Examples were provided to aid Ss in acquiring the basic argument, but the Ss were, on the whole, unable to solve the problems, as in Vernon's study (1950).

The superiority of recognition material over application (G and V subtests) was obvious from Table 1. Neither verbal nor graphic material was well learned by any group. It may be that much more intensive instruction must be given to produce learning differences which can be related to the methods of stimulus presentation.

The lack of significant differences in the two analyses using subtest RO and RA scores indicates there is no difference in recognition and recall learning with the four presentations. Again, this could be due to the fact that recognition and recall questions both involve factual information and this common factor causes the similar results.

Vernon has hypothesized that level of education is connected with the use of verbal or graphic presentations. This along with the Culbertson and Powers study (1964) implies that there should be correlations between certain intelligence test scores and learning, as measured by higher test scores

on the presented material. This study used a general intelligence test, Test B, a relational, nonverbal test, Test CF, and SAT verbal and mathematic scores to see if they correlated with ability to profit from the four forms of learning. Correlations with few test scores were over .35, although several are statistically significant, such as the CF correlation with V (.29), G (.32), and V and G subtest scores (.35) and total test score (.28) at the .01 level, and the .40 ($p < .05$) correlation of the verbal groups scores on the G subtest and Test CF. The SAT mathematics score correlated with subtest V (.25) and G (.26) at the .05 level, and with V and G (.29) and RO and RA (.29) and total test score at the .01 level.

Summary

The problem explored in this study was to determine which combinations of verbal and graphic materials lead to the most efficient learning. Ninety-one University college students participated. They were divided into 8 groups who read the same instructional material (on electrical circuitry), in verbal, graphic, verbal-graphic, or graphic-verbal form. Half of these Ss were pretested on the material. A recall and recognition posttest (with both verbal and graphic items) was administered immediately after reading. The finding that there were no retention differences among the various groups confirms earlier research. College students evidently can profit equally from these different types of presentations.

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Table 1

Subtest Means for the Four Presentations of Material

	Group (N=8)			
Subtest	V	G	VG	GV
Recognition	8.75	6.87	8.75	8.75
Recall	8.12	6.38	8.62	8.25
Verbal	2.50	1.63	1.38	1.00
Graphic	1.87	1.83	1.75	.88

Table 2

Significant Correlations Between Test Scores and Variables

Scores	Time (N=91)	Test CF (N=86)	SAT Math (N=80)	RO test (N=91)	G test (N=91)
V	.29	.29	.25*		.52
G	.29	.32	.26*		
V and G	.33	.35	.29		
RO	.28				
RA	.26*			.59	
RO and RA	.30		.29		
Total	.35	.28	.33		

Note: - *Significant at .05 level. All other correlations are significant at the .01 level.